

CLAIMS

- 1- A system for adjusting resonant frequencies in a linear compressor comprising, in the interior of a shell: a linear motor (20) supplied by an AC electrical current presenting a predetermined electrical supply frequency; a cylinder (1) within which is defined a compression chamber (CC) closed by a valve plate (2); a piston (10) reciprocating inside the cylinder (1) in consecutive suction and compression strokes; and an actuating means (9) operatively coupling the piston (10) to the linear motor (20), said piston (10) and actuating means (9) forming part of a resonant assembly, characterized in that it comprises:
- 15 - a detecting means (D) to detect a load imposed to the linear motor (20) of the compressor, in an operational condition of the latter related to the gas pressure in the discharge thereof; and
- 15 - a frequency adjusting means operatively associated with the detecting means (D) and with the resonant assembly, in order to define, as a function of the operational condition detected for the gas in the discharge of the compressor, a frequency adjustment by varying at least one of the values related to the mass 20 of the resonant assembly and to the average stroke of the piston (10), to a value of the mechanical resonance frequency of the resonant assembly corresponding to the electrical supply frequency, maintaining unaltered the minimum distance between the 25 piston (10) and the valve plate (2) at the end of each compression stroke.
- 30 2- A system, as set forth in claim 1, characterized in that the detecting means (D) detects at least one of the conditions of: pressure and temperature of the gas 35 compressed in the discharge of the compressor, and

operational electrical current of the linear motor (20).

3- A system, as set forth in claim 2, characterized in that it comprises a control unit (30) operatively connected to both the detecting means (D) and the adjusting means, in order to receive, from the former, information about one of the operational conditions of: pressure and temperature of the gas in the discharge of the compressor, and operational electrical current of the linear motor (20), and to instruct the adjusting means to provide one of the operations of varying the average stroke of the piston (10) and varying the mass of the resonant assembly.

4- A system, as set forth in claim 3, characterized in that the variation of the mass of the resonant assembly is achieved by modifying the mass of at least one of the parts defined by the actuating means (9) and the piston (10).

5- A system, as set forth in claim 4, characterized in that each part of the resonant assembly, to have its mass modified, comprises an internal chamber (11) containing an equalizing fluid and being maintained in fluid communication with an equalizing fluid reservoir defined in the interior of the compressor shell, the variation of the mass of the resonant assembly being achieved by modifying the mass of the fluid inside the internal chamber (11).

6- A system, as set forth in claim 5, characterized in that the internal chamber (11) of the piston (10) presents a constant volume, and being maintained in fluid communication with an equalizing fluid impelling means (130) provided in the interior of the shell in fluid communication with the equalizing fluid reservoir, in order to selectively pump said equalizing fluid into and out from said internal

chamber (11).

7- A system, as set forth in claim 6, characterized in that the equalizing fluid is defined by the lubricant oil of the compressor provided in an oil reservoir 5 defined at the bottom of the compressor shell.

8- A system, as set forth in any one of claims 2 and 3, characterized in that the variation of the operational stroke of the piston (10) is obtained by modifying the dead point of the piston (10) at the end 10 of the suction stroke.

9- A system, as set forth in claim 8, characterized in that the modification of the dead point of the piston (10) at the end of the suction stroke is achieved by an adjusting means in the form of an impeller (I), 15 which is operatively coupled to the resonant assembly and to the control unit (30), so as to be driven by the latter between an inoperative condition, in which it does not produce any alteration in the stroke of the piston (10), and an operative condition, in which 20 it modifies the stroke of the piston (10) for adjusting the mechanical resonance frequency of the resonant assembly to the electrical supply resonance frequency.

10- A system, as set forth in claim 9, characterized 25 in that the impeller (I) is one of the devices defined by an hydraulic actuator (40), a pneumatic actuator (50), and a mechanical actuator (60).

11- A system, as set forth in claim 10, characterized 30 in that the hydraulic actuator (40) is maintained in fluid communication with an equalizing fluid reservoir provided in the interior of the shell, said hydraulic actuator (40) being defined in a non-resonant portion of the compressor.

12- A system, as set forth in claim 11 and in which 35 the resonant assembly comprises a spring means (8)

coupling the resonant assembly to the non-resonant assembly (C) of the compressor, characterized in that the hydraulic actuator (40) is operatively coupled to the spring means (8).

5 13- A system, as set forth in claim 12 and in which in the bottom of the shell is defined a lubricant oil reservoir, characterized in that the equalizing fluid is defined by the lubricant oil of the compressor.

10 14- A system, as set forth in claim 10, characterized in that the pneumatic actuator (50) is maintained in fluid communication with a reservoir, for an equalizing fluid in the form of gas, provided in the interior of the shell, said pneumatic actuator (50) being defined in a non-resonant portion of the 15 compressor.

15- A system, as set forth in claim 14, in which the resonant assembly comprises spring means (8) coupling the resonant assembly to the non-resonant assembly (C) of the compressor, characterized in that the pneumatic 20 actuator (50) is operatively coupled to the spring means (8).

16- A system, as set forth in claim 15, characterized in that the pneumatic actuator (50) has a cylinder (91) incorporated to the non-resonant assembly (C) and 25 a plunger (92) axially displaceable in the interior of the cylinder (91) and which operates as a movable stop means onto which is seated the spring means (8) of the resonant assembly.

17- A system, as set forth in claim 16, characterized 30 in that the pneumatic actuator (50) is a bellows.

18- A system, as set forth in claim 10, characterized in that the mechanical actuator (60, 70, 80) is operatively coupled to the non-resonant assembly (C) and to the spring means (8) and operated by a driving 35 means (M), which moves said mechanical actuator (60,

- 70, 80) to different operational positions.
- 19- A system, as set forth in claim 18, characterized in that the driving means (M) is one of the devices defined by a motor, a hydraulic actuator, and a 5 pneumatic actuator.
- 20- A system, as set forth in claim 19, characterized in that the driving means (M) is operatively connected to the control unit (30).
- 21- A system, as set forth in claim 18, characterized 10 in that the mechanical actuator (60, 70) comprises one of the elements defined by a cam of linear displacement (61, 61') and a rotary cam (71) coupled to the non-resonant assembly (C) of the compressor, as well as a slide (64, 72) defining a cam follower 15 coupling one of said elements defined by the cam of linear displacement (61, 61') and the rotary cam (71) to the spring means (8).
- 22- A system, as set forth in claim 21, characterized 20 in that the cam of linear displacement (61) is provided with steps (62) which are dimensioned so as to define different positions for the dead point of the piston (10) at the end of the suction stroke.
- 23- A system, as set forth in claim 22, characterized 25 in that the slide (64) associated with the cam of linear displacement (61) carries a contact portion (64a) in a surface of said slide (64) confronting with the cam of linear displacement (61).
- 24- A system, as set forth in claim 23, characterized 30 in that the contact portion (64a) is a convex surface portion incorporated to the surface of the slide (64) confronting with the cam of linear displacement (61).
- 25- A system, as set forth in claim 21, characterized 35 in that the cam of linear displacement (61') presents one ramp surface (63') which is slidingly seated against a confronting inclined surface (66) of the

slide (64') of axial displacement.

26- A system, as set forth in claim 21, characterized in that the rotary cam (71) is provided with a continuous ramp (71a) which is dimensioned so as to 5 define, continuously, by actuating on the slide (72), different positions for the dead point of the piston (10) at the end of the suction stroke.

27- A system, as set forth in claim 18, characterized in that the mechanical actuator comprises a mechanical 10 stop means (80) threaded to the non-resonant assembly (C) and which is operatively coupled to the resonant assembly in order to alter the dead point of the piston (10) at the end of the suction stroke, when rotated around its longitudinal axis.

15 28- A system, as set forth in claim 10, characterized in that the equalizing fluid is the refrigerant gas compressed by the compressor.

29- A system, as set forth in claim 28, characterized in that it comprises a control valve (100) maintained 20 in fluid communication with the cylinder (91) of the pneumatic actuator (90) through at least one opening (93) of said cylinder (91), a control valve (100) lodging a sealing means (110) which is selectively displaced between a closed position, a pressurization 25 position and a depressurization position, in order to, selectively, block the opening (93) of the cylinder (91) upon discharge of the compressor and communicate the interior of the cylinder (91) with the interior of the compressor shell.

30 30- A system, as set forth in claim 29, characterized in that the sealing means (110) is a slide provided with an internal passage (111) and which is linearly displaceable in one and in the other direction, by the discharge gas pressure and by the return elastic means 35 (120), in order to provide the alignment and

disalignment of said internal passage (111) in relation to the opening (93).